Columbia River Salmon and Steelhead Endorsement
Application for Funding

Project Sponsor:
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Key Partners:
Quantitative Consultants Inc., Boise, ID

Project Title:
2017 Model for real-time estimates of salmonid escapement based on PIT tags

Type of Proposal:
New
This is a new project, but one that builds on past funded projects (i.e., PIT tag arrays). PIT tag arrays are now operational in all major tributaries in Eastern Washington except the lower Grande Ronde River.

Date of Submission:
Nov. 30, 2016

Effective Period of Funding:
March 1, 2017 –December 31, 2017

Project Location:
Columbia River Basin upstream of Bonneville Dam
The results of the project can be applied to many locations.

Total Amount of Funding Requested: $69,875

Project Description: The CRSSE program has funded the installation of PIT tag arrays in various locations in Eastern Washington with the expressed purpose of assisting fish managers in the execution of recreational fisheries. In order to facilitate and standardize how fish managers use data from PIT tag arrays, we propose to develop a general model to estimate detection probabilities and ultimately escapement of hatchery and wild fish at select PIT tag array locations that are critical in the execution of recreational fisheries. Near real-time estimates of escapement within fishery boundaries will provide managers improved data needed to maximize recreational opportunities without exceeding impacts to non-target fish or species.

The current method of estimating escapement of hatchery and wild steelhead to populations in the Upper Columbia is based on PIT tag detections of a random sample of fish tagged at Priest Rapids. To date, this has been a retrospective analysis, conducted at the end of the run season, when all detections throughout the year are assembled. We propose to adopt this framework to be run in- season, to provide managers with more real-time estimates of escapement to the Upper Columbia. This proposal includes three phases: (1) feasibility and reliability, (2) implementation, and (3) delivery of results.

Feasibility and reliability

The first step will be to evaluate over what spatial and temporal scales it is feasible to estimate escapement. Escapement estimates rely on several pieces of data, including estimates of total escapement past Priest Rapids Dam and detections at various in-stream PIT tag arrays around the Upper Columbia. These detections are used to simultaneously estimate movement probabilities among different tributaries and detection probabilities at each array. Reliable estimates of escapement are therefore dependent on sufficient detections to fit that model reasonably well. The initial phase of this project will be to determine how many detections are required, which provide guidelines as to what spatial scale (e.g. population or tributary) and temporal scale (e.g. weekly, bi-weekly, monthly) we can expect to provide reliable estimates. To do so, we will examine several lines of evidence. The first will be in a simulation context using a framework that has already been established to determine minimum thresholds for the number of detections. The second will be to use existing data from the Upper Columbia, and independent estimates of escapement such as counts at Tumwater Dam to evaluate how early in the season the model can be run, and how often it should be updated. The third may be to leverage data from a similar model in the Snake River basin to ask similar questions.

Implementation

Once feasible goals have been established in terms of how frequently and over what spatial scales to make escapement estimates, we will spend some time streamlining the implementation of this model. This involves automating the compilation of PIT tags that have been released from Priest Rapids, the data processing step of taking PIT tag detections and formatting them for this model, and estimating escapement past Priest Rapids in real time.

Delivery of results

To be useful to managers, real-time estimates of escapement must be disseminated in real-time as well. We propose to modify the BioMark "Data Manager" website (https://data.biomark.com/sign_in) to deliver escapement estimates as they become available over the course of the season. Data will be displayed in tabular and graphic formats, will include estimates of uncertainty, and will be updated in an automated fashion as interrogation data are accumulated.

Effort/Assistance Required: Assistance from Washington Department of Fish and Wildlife (WDFW) fish mangers in identifying important fishery locations.

Budget Summary: (See Table 1 at end of document for details.)

Salaries and Benefits:	$68,885
Goods and Services	
Supplies/equipment:	$41
Travel: Mileage	$613
Lodging	$182
Per Diem	$153
Total amount requested:	$69,874
Matching funds if applicable:	None

Benefit of Proposed Activity:

PIT tag arrays have been installed over a large geographic area in Regions 1, 2, and 3. Most PIT arrays also include the continuous collection of metadata (water depth, temperature, antenna performance (power and noise) that will be invaluable in estimating detection probabilities. The primary purpose of this large investment (~ $2M) has been to provide unbiased adult steelhead abundance estimates for selected populations. Over the last 5 years, WDFW and Quantitative Consultants Inc. (QCI) have developed methods to accurately and precisely use data from the arrays to estimate steelhead abundance in the Upper Columbia, but only after the run is complete. However, WDFW fish managers have requested more real time estimates of abundance to assist in the execution of recreational fisheries.

This proposal seeks to address that request with funding from the CRSSE program such that QCI and WDFW staff can jointly develop a generalized model that can be applied to most PIT tag arrays and species. Specifically, QCI will lead the model development and web design while WDFW oversee project management and reporting. Fish managers will have a standardized approach that should require minimal additional analysis to generate near real-time estimates of hatchery and wild fish. Near real-time estimates of both hatchery and wild fish through both space and time will provide managers:

1. Greater certainty in when and where to execute fisheries (i.e., open the fishery when hatchery fish are present and unnecessarily impacting wild fish when harvestable fish are not present thereby providing a higher quality fishing experience).
2. An estimate of wild fish abundance within the fishery area, not simply a total number (i.e., as wild fish move out of the fishery area, impacts can be more accurately estimated providing a longer fishing opportunity).
3. Potentially identifying new fishery areas where hatchery fish are present and wild fish are not (i.e., creating additional fishing opportunity).
4. Greatly reducing the risk of exceeding ESA take limits (i.e., demonstrating to NOAA that fishery impacts can be accurately and transparently estimated and thereby ensuring future fisheries are possible).

Additional Considerations:

Creel surveys conducted annually are costly and provide a coarse estimate of impacts to non-target species. Given that wild fish abundance levels are critical for opening fisheries and impacts to non-target fish are the primary mechanism for fishery closure, more accurate and precise estimates could provide additional fishing opportunities. A possible path forward in developing tools to estimate fishing impacts could include the following steps:

1. Develop PIT tag array infrastructure (completed)
2. Develop tools to estimate real-time fish abundance in fishery areas (this proposal)
3. Develop hooking mortality model to estimate fishery impacts to include a lower Snake River steelhead hooking mortality study in order to understanding the influence of warmer water temperatures (future proposal).

If fishery impacts can be successfully estimated using the models described and NOAA approves their use, CRSSE funding towards creel could be significantly reduced and funding can be used to develop additional fishing opportunities.

Project Reporting Due Date: Dec. 31, 2017.

Table 1. Line item budget

WDFW Salaries	**Units**	**Unit Price**	**Total**
Fish Biologist 3 (Project management, data analysis, reporting)	1.00	$5,253	$5,253
Subtotal	1.00		$5,253
WDFW Benefits	Base	Rate	
State OASI and Retirement	$5,253	0.1883	$989.14
Medical Aid	1.0	$148.78	$149
Health and Industrial Insurance	1.0	$894.00	$894
Subtotal			$2,032
WDFW Total Salaries			**$7,285**
QCI Salaries and Benefits	Units	Unit Price	Cost
Biometrician labor (model development)	400	$110	$44,000
Web designer labor (web design)	160	$110	$17,600
QCI Total Salaries			**$61,600**
Total Salaries and Benefits			**$68,885**
Goods and Services	Units	Unit Price	Cost
DOP Personnel Service Charge (Basis: total salaries)	$5,253	0.004058	$21
HRMS (Basis: total personnel months)	1	20	$20
Mileage (QCI to Wenatchee)	1,136	$0.54	$613
Lodging (QCI in Wenatchee)	2	$91	$182
Per diem (QCI in Wenatchee)	3	$51	$153
Total Goods and Services			**$990**
Total Salaries, Goods and Services, Equipment, and Travel			**$69,875**